CONTROLLING A RADIO RESOURCE CONTROL CONNECTION BETWEEN A BASE STATION AND A USER EQUIPMENT

FIELD OF INVENTION

[0001] The present invention relates to the field of cellular networks, especially to radio resource control connections within such networks, and in particular to radio resource control connections between a base station and a user equipment running an always-on application.

ART BACKGROUND

[0002] In cellular network systems, in particular in a global view, the overall volume of data traffic has come to exceed the overall volume of voice traffic. In addition, the sales of smart phones have been growing over the last years. A typical traffic pattern of smart phones is the sporadic transmission and/or reception of small data packets (in the amount of a few kBs), called heartbeats, followed by a longer period of data inactivity. When a heartbeat is due for transmission, smart phones setup a radio resource control (RRC) connection (if they are in idle state), exchange the data with the (always-on type of) application over the network and release the RRC connection when all data is exchanged. This process is repeated whenever the smart phone needs to update its status with the currently running application(s). This of course results in a high number of RRC connection setups and releases, thus, in a much larger amount of control signalling as compared to the amount of exchanged data.

[0003] A discontinuous reception (DRX) operation in an RRC connected state offers the possibility of battery savings and at the same time relaxes the control signalling problem by keeping DRX capable UEs RRC connected for a longer period of time, i.e. smart phones do not have to setup the RRC connection every time. However, this DRX approach in the RRC Connected state may provide disadvantages when mobility becomes a factor for the UEs under consideration. In such a case, keeping the UE longer RRC connected means that handovers (HOs) must be executed, the frequency of the HO depending of course on the UE speed and the cell size on UE's route. If the fact is considered that in terms of control signalling, a HO procedure outweighs the RRC connection (release and setup) procedure, and then one problem is exchanged by another.

[0004] There may be a need for an improved system and method being adapted to provide an efficient control of a radio resource connection avoiding the above mentioned problems.

SUMMARY OF THE INVENTION

[0005] This need may be met by the subject matter according to the independent claims. Advantageous embodiments of the present invention are described by the dependent claims.

[0006] According to a first aspect of the invention there is provided a method for controlling a radio resource control connection between a base station and a user equipment, wherein a radio resource control connection between the base station and the user equipment is established for exchanging control messages between the base station and the user equipment, the control messages being required for an application running on the user equipment. The method comprises determining a first value being indicative for a mobility characteristic of the user equipment and a second value being indicative for a data traffic characteristic of the user equipment, comparing the first value and the second value, setting a release timer based on the comparison, and controlling the radio resource control connection based on the release timer, wherein the radio resource control connection will end upon expiry of the release timer.

[0007] This aspect of the invention is based on the fact that, in particular for always-on applications running on the user equipment, keep-alive messages are required and will be transmitted regularly. This may either add a high rate of connection setups and releases, if the connection is ended after each transmission or, if the user equipment stays connected and is moving within the network, eventually a high rate of handovers. Thus, this aspect intends to reduce, as far as possible, the rate of handovers and the rate of connection setups and releases. In other words, it intends to provide a solution based on a decision for a specific user equipment, whether to maintain the connection and to accept eventually handovers, or whether to release the connection and to accept new connection setups.

[0008] The context of the invention may relate to LTE and to discontinuous reception (DRX) operation in an RRC_Connected state specified in LTE Rel-9. In the following, it will be referred in particular to smart phones running always-on type of applications during DRX operation in RRC_Connected state. However, the invention should not be seen as being limited to this kind of applications. Always-on applications require the periodic transmission and/or reception of keep-alive messages, in the following called heartbeats, by the smart phones. Depending on DRX availability, user equipment (UE) mobility and UE traffic characteristics, these rather small sized data packets (the heartbeats) can cause a higher amount of control signalling to the eNodeB or base station as compared to the actual amount of data exchanged over the air.

[0009] This aspect of the invention is based on the idea to provide a solution for containing the abovementioned control signalling caused by smart phone traffic within manageable levels for the eNodeB.

[0010] As already mentioned above, globally, the overall volume of data traffic has come to exceed the overall volume of voice traffic. In addition, the sales of smart phones have been growing over the last years. A typical traffic pattern of smart phones is the sporadic transmission and/or reception of small data packets (few kBs), called heartbeats, followed by a longer period of data inactivity. When a heartbeat is due for transmission, smart phones setup a RRC connection (if the smart phone is in idle state), exchange the data with the (always-on type of) application over the network and release the RRC connection when all data is exchanged. This process is repeated whenever the smart phone needs to update its status with the currently running application(s).

[0011] As discussed, this may result in a high number of RRC connection setups and releases and thus in a much larger amount of control signalling as compared to the amount of exchanged data. However, when keeping the connections for a longer time period, this may result in some other issues, when the UEs are mobile and travelling inside the network. In such a case, keeping the UE longer RRC_Connected means that handovers (HOs) must be executed. If the fact is considered that in terms of control signalling a HO procedure outweighs the RRC Connection (Release and Setup) procedure, one problem is traded for another.

[0012] In general, the following signalling is required for UEs being in RRC_connected state (connected mode DRX